

Having thus described the preferred embodiment, the invention is now claimed to be:

1. A vapor decontamination system for decontaminating a defined region, the system comprising:

at least a first duct along which a carrier gas is passed to the defined region;

5 a flash vaporizer for vaporizing a liquid which includes an antimicrobial compound into vapor, an outlet of the flash vaporizer being connected to the duct for supplying the vapor into the duct for absorption into the carrier gas passing through the duct at a mixing zone;

10 a means for introducing the liquid from a source to the flash vaporizer.

2. The system as set forth in claim 1 wherein the antimicrobial compound includes hydrogen peroxide and the flash vaporizer includes:

a metal block;

5 at least one heater for heating and maintaining the metal block at or above a vaporization temperature of hydrogen peroxide and below a hydrogen peroxide disassociation temperature; and

10 a passage extending through the block from an inlet to the outlet.

3. The system as set forth in claim 2 wherein the passage expands in cross section between the inlet and the outlet.

4. The system as set forth in claim 3 wherein the passage turns at least 180° between the inlet and the outlet.

5. The system as set forth in claim 4 wherein the passage includes at least two turns of approximately 90° and a wall therebetween, such that the liquid in the passage

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strikes the wall, thereby increasing a vaporization rate of the liquid antimicrobial compound.

6. The system as set forth in claim 4 wherein the passage includes:

a plurality of interconnected bores extending back and forth through the block between the inlet and the outlet.

7. The system as set forth in claim 1 further including:

a microbe trapping filter between the duct and the defined region.

8. The system as set forth in claim 1 further including:

a heater and a dehumidifier connected with the duct upstream from the injection zone.

9. The system as set forth in claim 8 wherein the duct includes:

an inlet upstream of the heater and the dryer connected with the defined region such that the carrier gas is
5 circulated from the duct inlet, through the heater and dryer, through the injection zone, and through a duct outlet into the defined region.

10. The system as set forth in claim 9 further including:

microbe trapping filters disposed adjacent the duct inlet and the duct outlet.

11. The system as set forth in claim 9 wherein the antimicrobial compound includes hydrogen peroxide and further including:

a hydrogen peroxide destroyer for decomposing
5 hydrogen peroxide vapor into water vapor and oxygen, the

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destroyer being disposed upstream from the dryer.

12. The system as set forth in claim 1 further including:

a source of carrier gas connected with the flash vaporizer inlet for creating a positive pressure differential
5 from the flash vaporizer to the absorption zone.

13. The system as set forth in claim 1 further including:

at least one additional flash vaporizer and means for introducing liquid connected with the duct.

14. The system as set forth in claim 1 further including:

at least a second duct; and,

at least a second flash vaporizer and means for
5 introducing liquid connected with the second duct.

15. The system as set forth in claim 1 further including:

a first plurality of monitors connected with the duct upstream of the injection zone;

5 a second plurality of monitors disposed in the defined region;

a controller connected to the monitors for controlling the means for introducing liquid in accordance with monitored conditions in the duct and in the defined area.

16. The system as set forth in claim 1 further including:

fans disposed in the defined region for circulating vapor into partially occluded subregions.

17. The system as set forth in claim 1 wherein the means for introducing includes a metering pump.

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18. A method of decontaminating a defined area, the method comprising:

pumping a carrier gas through a duct to the defined region;

5 injecting an antimicrobial vapor into the duct at a mixing zone upstream of the defined region.

19. The method as set forth in claim 18 wherein carrier gas flow through the duct is at the rate of at least 20 cubic meters per minute and the defined area is an enclosure of at least 10,000 cubic meters.

20. The method as set forth in claim 18 wherein the antimicrobial vapor includes hydrogen peroxide and further including:

heating a block which has an internal passage to a
5 temperature sufficient to vaporize the hydrogen peroxide but which temperature is lower than a temperature which disassociates hydrogen peroxide;

passing hydrogen peroxide into the passage through the block to vaporize the hydrogen peroxide;

10 passing the hydrogen peroxide vapor from the passage into the mixing zone;

mixing the hydrogen peroxide vapor into the carrier gas flow.

21. The method as set forth in claim 20 further including:

blowing carrier gas through the passage with the hydrogen peroxide to create a positive pressure differential
5 between the passage and the duct.

22. The method as set forth in claim 20 further including heating and drying the carrier gas in the duct upstream of the mixing zone.

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23. The method as set forth in claim 18 further including:

pulling carrier gas with antimicrobial vapor from the enclosed area through a microbe-trapping filter;

5 drying and heating the carrier gas and passing the dried, heated carrier gas to the duct upstream of the mixing zone.

24. The method as set forth in claim 23 further including anti-microbially filtering carrier gas between the duct and the defined area.

25. The method as set forth in claim 18 wherein the defined region is a large room and the duct includes existing HVAC duct work.

26. The method as set forth in claim 25 further including:

supplying carrier gas through a plurality of ducts into the room;

5 injecting hydrogen peroxide vapor into the carrier gas in each of the ducts.

27. The method as set forth in claim 18 further including:

directing antimicrobial vapor in the defined region against at least one surface to be decontaminated.

28. The method as set forth in claim 18 further including:

monitoring concentration of the antimicrobial compound in the vapor in the room and carrier gas conditions
5 in the duct upstream of the injection zone, and

controlling a rate at which the vapor is supplied to the duct in accordance therewith.

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29. The method as set forth in claim 18 further including:

monitoring concentration of the antimicrobial compound in the vapor in the defined area until the
5 concentration reaches a preselected level; and

holding the vapor in the defined area without further addition of vapor for a period of time.

30. The method as set forth in claim 18 further including:

heating a block above a vaporization temperature of a peroxy compound;
5 metering the peroxy compound in liquid form into an internal bore in the block to vaporize the peroxy compound.

31. The method as set forth in claim 30 further including:

entraining the liquid peroxy compound into a controlled air flow upstream from the block.

32. The method as set forth in claim 31 wherein the internal bore turns and further including:

propelling peroxy compound droplets into bore surfaces at turns in the internal bore.

33. A method of decontaminating an enclosure comprising:

providing a first carrier gas stream and a second carrier gas stream, the first stream having a lower flow rate
5 than the second stream:

introducing the first stream to a passage, the passage having at least one bend;

introducing a flow of an aqueous solution of a peroxy compound into the passage upstream of the bend, the
10 peroxy compound mixing with the first stream, walls of the passage being heated to vaporize the aqueous solution;

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mixing the vaporized aqueous solution and first
carrier gas stream with the second carrier gas stream in a
mixing zone downstream of the passage and transporting the
15 mixed vaporized aqueous solution and first and second carrier
gas streams to the enclosure.

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